

Carsch *et al.* now report preparation of a copper nitrene complex from an azide precursor. X-ray absorption and diffraction studies support a triplet electronic state that does not engage in multiple bonding with the copper center. —JSY

Science, this issue p. 1138

TOPOLOGICAL OPTICS

How to define a light path topologically

Controlling the flow of light in a robust and flexible manner will be critical for the development of the next generation of photonic integrated devices. Exploiting the inherent protection afforded by topology, topological photonics provides a solution for the robust propagation of light. Devices so far, however, have been fixed in their functionality. Zhao *et al.* created light paths that can be arbitrarily switched on and off by optical illumination. Propagation can be topologically steered along desired pathways by manipulating regions of gain and loss within the photonic structure through optical excitation. This approach provides a route to controlling topologically protected light paths in an integrated optical platform. —ISO

Science, this issue p. 1163

NEONICOTINOID IMPACTS

Hazardous delays

Neonicotinoids are a widely used group of pesticides that have been shown to have negative impacts on an increasing number of species, most notably pollinators. Eng *et al.* tested how exposure to these compounds influenced the behavior of a migrating songbird. Ingestion of field-realistic levels of neonicotinoid insecticides reduced feeding and accumulation of body mass and fat stores, which led to delayed departure from stopover sites. Such delays can lead to reduced migration survival and decreased reproductive success and therefore have the potential to impose population-level impacts. —SNV

Science, this issue p. 1177

CAR-T CELLS

Taming tonic signaling for immunotherapy

Adoptive transfer of T cells engineered to express a chimeric antigen receptor (CAR) is an effective therapy for select lymphomas. The potency of this therapy can be limited by antigen-independent or tonic signaling, which results in progressive inactivation of CAR-T cells. Fisher *et al.* found that CAR-T cell expansion increased tonic signaling in $\alpha\beta$ T cells but not in $\gamma\delta$ T cells. When $\gamma\delta$ T cells were engineered to express a chimeric costimulatory receptor, they specifically recognized transformed but not healthy myeloid cell targets. —ERW

Sci. Signal. **12**, eaax1872 (2019).

SOCIAL SCIENCES

Assessing U.S. support for gene drives

Proponents of gene drive technology argue that it could revolutionize pest management, but how will it be received by the public? Jones *et al.* used a representative sample to assess public attitudes in the United States toward genetically modified agricultural insect pests in general and gene drives specifically. When informed of the potential risks and benefits of gene drives, respondent support or opposition depended on whether the spread of a gene drive could be carefully limited, whether native or non-native species would be targeted, and whether the drive would suppress or replace target species. Respondents expressed greater trust in universities and the U.S. Department of Agriculture to assess these questions than in private industry or the U.S. Department of Defense. These findings provide important insights for researchers, industry, and policy-makers in upholding public trust in gene drive development and risk assessment. —AC

Sci. Adv. **10**, 1126/
sciadv.aau8462 (2019).

IN OTHER JOURNALS

Edited by **Caroline Ash**
and **Jesse Smith**

CIRCADIAN RHYTHMS

Too sleepy to drive?

We all recognize that feeling when our eyes start to droop and we really cannot go on. But before our impairment becomes obvious to ourselves, our capabilities may already be significantly affected. Objective measures of impairments that do not rely on subjective judgments could help to improve safety. Stone *et al.* developed a range of eye movement tests that could identify people who were overly tired owing to lack of sleep. They examined a group of six men and six women who were initially assessed when well rested and then subjected to an acute sleep deprivation protocol. Many features of the subjects' eye movements when following unpredictable targets were deficient. Similar noninvasive assessments of professional machine operators could provide a useful safety check and prevent accidents caused by sleep loss or circadian disruption. —SMH

J. Physiol. **597**, 4643 (2019).

The dangerous early effects of sleep deprivation may not be obvious.

STRUCTURAL BIOLOGY

Moving a motor

In mammalian cells, dynein 2 is vital for cilia's role in cell movement, sensing, and signaling. Dynein 2 transports cargo out of the cell cilia. It assembles at the base of the cilium with polymers called intraflagellar transport (IFT) trains and is carried to the top of the cilium by another motor molecule called kinesin II. Toropova *et al.* determined the structure of the complete dynein 2 complex using cryo-electron microscopy. Two copies of the heavy chain, which comprises an N-terminal domain, a long tail, and the motor domain, are brought together by nonmotor subunits. The interactions stabilize an autoinhibited conformation and constrain the tails into two different conformations, one straight and one zigzag. Docking studies show that the zigzag conformation matches the periodicity of the IFT polymer and that successive dynein 2 complexes interdigitate, making binding to IFT trains cooperative. —VV

Nat. Struct. Mol. Biol. **26**, 823 (2019).

CAREER DEVELOPMENT

Leaving the lab in graduate school?

The academic system cannot support the current volume of Ph.D. students, and the lack of training in transferrable skills during graduate school compounds this problem. To investigate the efficacy of internships as career exploration tools, Chatterjee *et al.* used a cohort model where graduate students completed one internship as part of the Broadening Experiences in Scientific Training program. Participants described having learned marketable skills, or CV builders, that they predicted would help differentiate them in the job market. Additionally, participants described a variety of ways that they were able to transfer their industry learning back to their academic and research lab context. Perhaps most valuable were the industry mentoring and networking opportunities, which help show students that there is more than one way to be a scientist. —MMc

CBE Life Sci. Educ. **18**, ar20 (2019).



CLIMATE EMERGENCY Not looking forward to more surprises

Adaptation of human organizations to changing conditions tends to be motivated by the expectation that past conditions provide insight into future conditions. However, as the climate heats up, the frequency of extreme “surprise” events, such as flash floods or heat waves, is increasing. In their analysis of temperature spikes experienced in the oceans, Pershing *et al.* found that before 1940, surprise

events were rare. The number of surprises accelerated after 1998, following a powerful El Niño. Unlike most other organisms, humans can change their life strategies and with some insight might be able to adapt their associated economies. However, the models show that relying on past behavior is an inaccurate guide to the future. Although the immediate rewards might be lower, it would profit humans to take a forward-looking strategy to spread the risk across surprise events—an adaptive strategy that, the

authors warn, may require more “surprises” to motivate humans to adopt. —CA

Proc. Natl. Acad. Sci. U.S.A. 10.1073/pnas.1901084116 (2019).

BIOMATERIALS Detecting oxygen in growing tissues

Cells require sufficient oxygen for survival and differentiation, for example, during bone tissue regeneration. With the aid of probe molecules, two-photon phosphorescence lifetime microscopy (2PLM) can image oxygen distributions, although not in tissues lacking vasculature. Schilling *et al.* use electrospin polymer meshes by employing a coaxial approach to embed 2PLM probes into the cores of fibers. The fibers support bone marrow stromal cell growth and differentiation, while enabling real-time high-resolution probing of partial pressures of oxygen during the early stages of tissue repair both in vitro and in vivo. —MSL

ACS Appl. Mater. Interfaces 10.1021/acsami.9b08341 (2019).

ARCTIC SEA ICE Warming from loss

Arctic sea ice is disappearing at an alarming rate, a situation with many potential consequences including an acceleration of warming due to a decrease in albedo. Pedersen and Christensen used a suite of climate models to study how sea ice loss in various regions of the Arctic affects surface temperatures across Greenland. They found that ice loss near Greenland has the strongest warming effect on adjacent coastal regions but little impact on the interior of the ice sheet. Sea ice loss in the remote central Arctic has no significant influence on central Greenland. So, although sea ice loss can be the major cause of warming in coastal areas, the bulk of Greenland is much more sensitive to global factors. —HJS

Geophys. Res. Lett. 10.1029/2019GL083828 (2019).

BIOINFORMATICS Hidden treasure in the microbiome

We know that the human microbiome contains a wealth of largely unknown genetic diversity. Whole metagenome shotgun sequencing is needed to make the links between genes and phenotypes. Sberro *et al.* have computationally analyzed thousands of small protein-coding genes in the Human Microbiome Project data. More than 400,000 clusters of open reading frames (ORFs) of less than 150 nucleotides were constructed de novo. Within the approximately 4000 small ORFs likely to be protein-coding, the majority have no homology with known protein domains, and some are evolutionarily conserved, indicating that they have essential functions. Some peptides are transmembrane and secreted, which hints that they are used in signaling between bacteria and host. Others are implicated in bacterial immunity and horizontal gene transfer. Thus, this effort provides a rich resource for understanding the body’s relationship with its microbiota. —SYM

Cell 178, 1245 (2019).



Planning for future climate “surprises” requires forethought not hindsight.

PHOTO: NOEL CELIS/AFP/GETTY IMAGES

Science

Not looking forward to more surprises

Caroline Ash

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